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Occupational Safety and Health Administration

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Occupational Exposure to Toluene

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[29 CFR Part 1910]

[Docket No. H–026]

OCCUPATIONAL EXPOSURE TO TOLUENE

Notice of Proposed Rulemaking

Pursuant to sections 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (the Act) (84 Stat. 1593, 1599; 29 U.S.C. 655, 657), and Title 29, Code of Federal Regulations (CFR) Part 1911, it is proposed to amend Part 1910 of Title 29 by deleting the present standard for toluene contained in 29 CFR 1910.1000, Table Z–2 (formerly § 1910.93, Table G–2), and by adding a new occupational safety and health standard for exposure to toluene as 29 CFR 1910.1029. This standard would apply to all employments in all industries covered by the Act, including "general industry," construction, and maritime. In addition, pursuant to section 4(b)(2) of the Act (84 Stat. 1592, 29 U.S.C. 653), if the new standard, when promulgated, is determined to be more effective than corresponding standards now applicable to the maritime and construction industries contained in Subpart B of Part 1910, Parts 1915, 1916, 1917, 1918, and 1926 of 29 CFR, the new toluene standard will supersede the corresponding maritime and construction standards for exposure to toluene. Appropriate conforming amendments will be made in Subpart B of Part 1910, and amendments to delete the superseded standards will be made in 29 CFR 1926.55 and in similar sections of Parts 1915–1918.

The accompanying document is a proposal, issued pursuant to sections 6(b) and 8(c) of the Act. The Agency requests the submission of written comments, data, and arguments from interested persons on a variety of issues addressed or implicit in the proposal. In addition to filing comments, interested persons may also file objections to the proposal, requesting an informal hearing with respect thereto.

The present standard, listed in Table Z–2 of 29 CFR 1910.1000, limits employee exposure to concentrations of toluene in air to an 8-hour time weighted average (TWA) of 200 parts per million (ppm) and a ceiling of 300 ppm. The proposed new standard would reduce the TWA to 100 ppm and reduce the ceiling to 200 ppm. In addition, the proposed standard would add specific requirements for measuring employee exposures, methods of compliance, respiratory protection, hazardous and emergency situations, protective equipment, housekeeping, training, signs and labels, medium surveillance, and recordkeeping.

The issues raised in the proposal include, among others, the following:

(1) The selection of an appropriate time-weighted average and a ceiling level for toluene;

(2) The provisions for, among other things, employee exposure measurements, compliance procedures, medical surveillance, protective equipment and clothing, hygiene facilities, and recordkeeping; and

(3) The environmental and inflationary impact of this proposal.

I. Background

A. *Introduction.* Toluene (methylbenzene, methacide, phenylmethane, toluol), Chemical Abstracts Service Registry Number 108883, is a colorless, volatile and flammable liquid with a sweet, pungent, benzene-like odor. It is an aromatic hydrocarbon, with a molecular structure distinguished from that of benzene by the substitution of a methyl group (CH_3) for one hydrogen atom. Toluene reportedly was discovered in 1835 by Pelletier and Walter as a degradation product obtained from heating the natural resin, balsam of Tolu, named for a small town in Colombia, South America.[1]

Until World War II toluene was obtained primarily as a by-product of coke production. The need for large quantities of toluene in the production of TNT during World War I fostered its production from petroleum for the first time, and this was further stimulated by World War II. By 1966, 96 percent of the United States production was obtained from petroleum.[1] United States production of toluene in 1974 was 1,035 million gallons.[2] Approximately 70 percent is used in the manufacture of benzene, and 15 percent is used in the manufacture of other chemicals. The remainder is used as a solvent for paints and coatings or as a component of gasoline.[3] NIOSH has estimated that 100,000 persons or more in the workforce could have potential exposure to toluene.[4]

B. *History of Regulation.* In 1943 the U.S. Public Health Service published a table of toxic limits which recommended that human exposure to toluene not exceed 200 ppm, based on the 1942 reports of von Oettingen et al[5,6] and Greenburg et al.[7]

The Z37 Committee of the American National Standards Institute (ANSI) in 1943 published a standard of 200 ppm for an 8-hour daily exposure to toluene based likewise on the reports of von Oettingen and Greenburg. ANSI has periodically reaffirmed this standard, and in 1969 a time-weighted average of 200 ppm was approved. A ceiling of 300 ppm was also recommended along with an acceptable maximum excursion of 500 ppm for a duration of not more than 10 minutes, provided such an exposure is encountered not more than once a day.[8]

In 1974, the Z37 committee revised the toluene standard, reducing the 8-hour time-weighted average concentration to 100 ppm, the ceiling concentration to 200 ppm, and leaving the acceptable maximum peak above the acceptable ceiling concentration at 500 ppm for a duration of not more than 10 minutes provided such an exposure is encountered not more than once per day.[9]

In 1947 the American Conference of Governmental Industrial Hygienists (ACGIH) established a Threshold Limit Value (TLV) for toluene of 200 ppm, based on the report of Wilson[10] that physical findings among workers exposed to toluene concentrations below 200 ppm were essentially negative.[11] In 1971, ACGIH lowered the TLV for toluene to 100 ppm on the basis of irritative effects on the eyes, mucous membranes, and upper respiratory tract of individual subjects exposed variously to 200 to 500 ppm.[12]

In 1957 the Hygienic Guides Committee of the American Industrial Hygiene Association recommended a Maximum Atmospheric Concentration (MAC) of 200 ppm of toluene vapor by volume for 8 hours. This MAC was based on human experience in industry and toxicologic observations in animals.[13]

The present OSHA standard for toluene was part of the package of standards promulgated May 29, 1971, under the provisions of section 6(a) of the Act. It was taken from ANSI Standard Z37.12–1967 and consists of three air concentration limits: an 8-hour time-weighted average of 200 ppm (parts by volume of toluene vapor per one million parts of air); a ceiling of 300 ppm; and a peak of 500 ppm allowed not longer than 10 minutes during an 8-hour shift.

II. Occupational Health Implications

A. *General Considerations.* Toluene is normally brought into the workplace as a liquid, sometimes relatively pure, but often as a component of a mixture or contaminated with other liquid hydrocarbons. Open to the atmosphere, the liquid evaporates at a moderate rate (vapor pressure = 28 mm Hg @ 25°C) resulting in contamination of the air with a heavy vapor which has a tendency to "creep" downhill and concentrate in low places. Liquid toluene is flammable and its vapor forms explosive mixtures with air. Its explosive limits by volume in air are 1.27–7.0 percent. In addition, poorer grades of toluene may be contaminated with significant amounts of benzene (as much as 25 percent).[14] Because of its injurious effects on the hematopoietic system and its high rate of evaporation, the benzene contaminant may pose a greater health hazard.

In the occupational environment, toluene exposure most often occurs by breathing contaminated air. The inhaled vapor is rapidly absorbed. Sixteen to 20 percent of the absorbed toluene is eliminated by the lungs unchanged and less than 0.1 percent is excreted unchanged in the urine.[15] Most of the absorbed toluene (approximately 80 percent) is oxidized to benzoic acid, conjugated with glycine in the liver to hippuric acid, and excreted in the urine. Ikeda and Imamura,[16] using data from Ogata, et al.,[17] have calculated the biological half-life of the metabolite, hippuric acid, to be 6.3 hours. With heavy toluene absorption a small amount of benzoic acid is conjugated with glucuronic acid to benzoylglucuronic acid. Bakke and Scheline,[18] in studies with rats, found that about one percent of the toluene dose is hydroxylated to o- and p-cresol. Further-

See Section VI for list of references.

more, they detected small amounts of benzyl alcohol in hydrolyzed urine extracts which suggested that benzyl alcohol may be an intermediary in the production of benzoic acid.

The most obvious and serious effect of acute exposure to toluene (which does not distinguish it from other hydrocarbon solvents) is depression of the central nervous system, with headache, drowsiness, muscular weakness, neuromuscular incoordination, nausea, vertigo, paresthesia of the skin, diluation of the pupils and, for very high exposures (in the order of thousands of ppm), coma and death.[5,6] Chronic high level exposures have resulted in permanent encephalopathy in humans,[19] and definite nervous system tissue pathology has been seen in animals following chronic high level exposures.[20]

B. *Effects on Central Nervous System.* Well documented reports of experimental and occupational inhalation exposure of humans to essentially pure toluene are few. One such report is by von Oettingen et al. (1941).[5,6] The toluene used was shown by spectrophotometric analysis to contain not more than 0.01 percent benzene. Three human volunteers were exposed to controlled air concentrations of 0, 50, 100, 200, 300, 400, 600, and 800 ppm 2 days per week over a 3-month period. Each exposure lasted, "as a rule," 8 hours with a half-hour intermission for lunch except for the 800 ppm exposure where the exposures were 3 and 2 hours per day with a 2 hour rest period between exposures.

Sojourns in the exposure chamber for 8 hours with no exposure to toluene vapors resulted in no complaints or objective symptoms except occasional, moderate tiredness toward the end of the experiment. This may be easily explained by the lack of physical exercise, unfavorable illumination, monotonous noise (fans) and similar factors necessarily connected with an experiment of this type.

With exposure to 50 ppm of toluene in air, one of the subjects had no complaints, whereas another complained of drowsiness and mild headache toward the end of the experiment. Upon discontinuation of the exposure he completely recovered and had no after effects. In addition, at the end of the experiment the pupils of this subject were dilated and the accommodation to light was slightly impaired.

During exposure to 100 ppm, two of the subjects had no subjective complaints except for moderate fatigue and sleepiness, and the third complained of a slight headache on one occasion. In contrast to these minor results in experiments 1 and 2, two subjects who were exposed to the same concentration on two occasions after having been exposed to toluene in air at higher levels (up to 800 ppm) in the course of the preceding three weeks, complained of extreme fatigue during and after exposure. One also showed moderate incoordination, and the other complained, in addition, of severe headache, muscular weakness nervousness and paresthesia and also showed, on one occasion, dilation of the pupils at the end of the exposure.

With exposure to 200 ppm of toluene in air, all three subjects felt fatigued toward the end of the experiment; two of them experienced on several occasions muscular weakness, confusion and paresthesias of the skin. One complained repeatedly of headache and another complained of nausea at the end of the exposure. Two subjects showed impaired coordination. In several instances the pupils were moderately dilated, the accommodation to light was impaired, and the eyeground was engorged at the end of the exposure. During the hours following the exposure, all three subjects felt more or less fatigued and generally confused. They repeatedly complained of moderate insomnia and restless sleep.

With exposure to 300 ppm, all three subjects experienced more or less severe fatigue. Two of them complained of muscular weakness. The latter also showed signs of incoordination. Two subjects showed slight pallor of the fundus, but it was not determined whether accommodation to light was impaired. Several hours following the exposure, all three subjects felt more or less fatigued and one of them complained of insomnia during the following night.

With exposure levels increasing from 400 to 800 ppm, all subjects had increasing degrees of nausea, fatigue, confusion, and loss of coordination. All subjects showed considerable after-effects at the highest levels lasting at least several days and characterized by severe nervousness, muscular fatigue and more or less severe insomnia. Von Oettingen et al. concluded that:

> These observations appear to indicate that exposure for eight hours to 200 parts per million of toluene in air produces definite impairment of certain nervous functions which, especially in hazardous operations, is liable to render persons thus affected dangerous to their own safety and the safety of the operation.

At 100 ppm the subjective symptoms were little different from those seen at 50 or 0 ppm except when the subjects had had recent exposures to higher levels of toluene: 200 ppm 3 days before, 400 ppm 7 days before, 600 ppm 14 days before and 800 ppm 21 days before. This indicates that a residual burden of toluene or its metabolites from the recent high exposure remained. The relatively severe effects seen from low level exposures following previous high level exposures appear to be the result of the superimposition of the burden from the last exposure on the residuals of the prior exposure.

Ogata et al[17] (1970) reported their physiological observations on human subjects exposed to concentrations of 100 ppm and 200 ppm toluene in air for 7-hour periods with a one-hour lunch break after the first 3 hours. At 200 ppm they found a prolongation of reaction time, a decrease in pulse rate, and a decrease in systolic blood pressure. They concluded, "* * * we do not consider that 200 ppm of toluene is safe * * *."

Wilson[18] (1943) reported his observations of the effects of toluene exposure in workers in a large industrial plant. The chief complaints of employees exposed to concentrations up to 200 ppm were headache, lassitude and loss of appetite. The author considered these symptoms to be due chiefly to "psychogenic" factors rather than to toluene vapor. However, he recommended that the concentration of toluene where an employee might be working should be kept below 200 ppm.

Carpenter et al[21] (1944) listed the subjective symptoms reported by two human subjects exposed to controlled levels of toluene as follows:

> 200 ppm: (7 hours' exposure with 1-hour lunch break) mild eye irritation, lacrimation when performing the steadiness test, lassitude, quickly passing nausea, and hilarity.
>
> 600 ppm: (8 hours' exposure with 1-hour lunch break) lassitude, hilarity, verbosity, boisterousness; after termination of exposure anorexia and listlessness.
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> 800 ppm: (8 hours' exposure with 1-hour lunch break) metallic taste, transitory headache, extreme lassitude, scotomata, verbosity, inebriation, slight nausea.

Capellini and Alessio[22] (1971) reported the complaints of one worker employed in the preparation of a toluene-containing mixture which resulted in a mean exposure of 250 ppm with extremes of 210 and 300 ppm. The worker complained of irritation of the conjunctiva, feelings of stupor during work, insomnia and nervousness.

Longley et al[23] (1967) reported an acute exposure incident in 1967 in which 29 men were exposed to concentrations of toluene between 10,000 and 30,000 ppm. Exposure to these concentrations for unspecified periods produced dizziness, "drunkenness," collapse, and loss of consciousness. However, the workers recovered spontaneously after being removed from the contaminated atmosphere. No after-effects were noted 2 months following the exposure.

Satran and Dodson[24] (1963) reported a case of toluene habituation extending over a 10-year period. Effects of acute intoxication included headache, "inappropriate speech," and brief episodes of memory loss. Despite the subject's long period of toluene exposure, which produced many episodes of unconsciousness, there was no evidence of systemic pathological abnormalities. Electroencephalographic abnormalities were found, consisting of excessive episodic slow activity and occasional sharp, nonfocal discharges. These findings were regarded as being consistent with diffuse encephalopathy, but the features of the record were nonspecific.

Knox and Nelson[19] (1966) reported the first case of permanent encephalopathy in man caused by repeated, prolonged exposure to toluene vapor. The subject of the study, a 33-year-old male, inhaled pure toluene vapors several times daily over a 14-year period. The result of this addiction was permanent cerebral atrophy with clinical signs of ataxia, tremu-

See Section VI for list of references.

lousness, emotional lability, marked snout reflex (distorted nostrils on subjection to sniff test), and positive Babinski toe reflex on the rightside. The individual's brain damage was confirmed by both electroencephalography and pneumoencephalography.

Gusev[25] (1965) reported an intensification of electric potentials in the electroencephalograms of four human subjects, upon inhalation of concentration of 0.27 ppm of toluene vapor. The relevance of these effects, and their relationship to any known significant central nervous system effects, if any, have not yet been determined.

C. *Effects on the Hematopoietic System.* Because toluene is a homolog of benzene, and because benzene has a leucotoxic effect on humans, OHSA believes that it is necessary to discuss the reported effects of toluene upon the human hematopoietic system. In addition, many of the studies in the literature have been conducted using toluene contaminated with benzene, with the result that many of the possible toxic effects of benzene may be present in these toluene studies.

Greenburg et al.[7] (1942) studied 61 workers exposed to toluene, but no other toxic volatile solvents, for periods extending from 2 weeks to 5 years. Reported atmospheric concentrations ranged from 100 ppm to 1,100 ppm in increments of approximately 100 ppm. Although he did not report severe illness, Greenburg found evidence of mild intoxication, enlarged livers, macrocytosis, mild depression of the erythrocyte level, absolute lymphocytosis, and elevation of the hemoglobin level and the mean corpuscular hemoglobin concentrations. The investigators concluded that early chronic toluene intoxication in man is "best evidenced by hepatomegaly" (enlargement of the liver and "macrosytosis" (enlarged red blood cells). It should be noted, however, that Greenburg could not make a comparison between the observed toxic effects and the degree of toluene exposure. Also, enlargement of the liver in itself has not been shown to be a pathological response. It may be only normal adaptation to stress.

Von Oettingen[5,6] et al. (1942) (discussed above) reported on the effects of the exposure of three human subjects to concentrations of 50 to 800 ppm. The subjects were exposed 15 times over a 3-month period. No abnormal changes were detected in the peripheral blood leukocyte count.

Brailer[26] (1954) reported on the absence of toxic effects in human leukemia patients treated with up to 10 grams per day of toluene, administered orally in olive oil, for a total of 130 grams in three weeks. The toluene had been administered because it was believed to have effects on the bone marrow similar to that of benzene. Brailer hypothesized that the difference in the toxicity of benzene and toluene was due to the presence of a methyl group in toluene that is not present in benzene.

To test his hypothesis, Brailer administered to his patients, simultaneously with benzene, choline and methionine, carriers of methyl groups which cannot be synthesized in the human organism. He theorized that methyl groups donated by the carriers would be utilized in the methylation of benzene to nontoxic toluene. The results in his experiments confirmed his hypothesis and, in fact, the administration of benzene with methyl-donating compounds did not result in hematological abnormalities in contrast with the effects observed when benzene alone is administered. In discussing this and other studies, Francone and Brailer concluded that toluene does not have a toxic action on the blood-forming tissues because of the presence of the methyl group, and that benzene acts in the same manner when administered simultaneously with carriers of methyl groups.

Parmeggiani and Sassi[27] (1954) reported on a study of 11 paint and pharmaceutical industry workers exposed to toluene vapors ranging from 200 to 800 ppm. Although irritation of the conjunctiva and upper respiratory tract mucosa was found in one worker, and nervous excitability in six others, the authors concluded that toluene has no particular action on the bone marrow or other organs. Therefore, the authors expressed the opinion that workers can have exposure to 300 ppm toluene without hazard to health.

Banfer[28] (1961) reported his study of the effect of toluene containing 0.3 percent benzene on the peripheral blood elements (RBC, Hgb, WBC, and granulocytes) on 889 rotogravure printers and helpers employed for more than 3 years. These subjects were compared with 478 nonexposed persons in the same industry. The only environmental air levels reported consisted of samples taken on a single day from five different places in the machine room. Three samples showed the toluene concentration to be below 200 ppm, and the fifth sample indicated 400 ppm. Banfer found no effects on the formed elements of the blood among the exposed workers that were different from the control group. Six sternal biopsies were also reported, but no pathological changes of the bone marrow were found.

Bansagi[29] (1968) found a decreased phagocytic activity of the polymorphonuclear leukocytes in workers exposed to toluene vapors in the printing industry. However, there was no apparent relationship between the decrease of phagocytic activity and the degree of exposure to toluene. In addition, the benzene content of the toluene referred to in this study was not reported.

Cieslinska et al.[30] (1969) studied the serum levels of iron and copper and the urinary excretion of porphyrins in 51 female workers having an occupational history of exposure to toluene. The authors interpreted their findings of altered levels of iron or copper in three different groups of these subjects to suggest that toluene, as well as benzene, has a harmful action on the hematopoietic tissue, although there were no clinical changes observed in these workers. The investigators emphasized the similarity of the toxic responses evoked by benzene and toluene. However, the workers in the study had exposure to a combination of benzene and toluene, so the toxic effects could not be specifically attributed to toluene exposure.

Pacseri and Emszt[31] (1970) reported the results of blood studies made on 191 workers in four printing firms. Fifty-two of the subjects had worked in printing shops longer than 10 years, 73 had worked between 5 and 10 years, and 66 had worked from 1 to 5 years in printing shops. The solvent used for printing in each case was stated to be pure toluene, completely free of benzol or having only traces of benzol. The authors also noted that the exposure levels experienced by the print shop workers exceeded the currently acceptable level (in Poland) of 50 mg/m (13.5 ppm) by as much as 20 to 30 times (265–398 ppm).

The investigators found no significant abnormalities in the white and red corpuscle counts in the 191 subjects. The variations from normal for lymphocytes, thrombocytes, and leukocytes were no greater than might be seen in a group of controls. There was, however, an indication that toluene exposure may lower the level of prothrombin. This finding was not conclusive, however, and the authors planned to request that further specialized hematological studies be undertaken.

Eleven of the 191 workers had enlarged livers, but no case of liver dysfunction was found. In their concluding comments, the authors stated that "the high level of toluol pollution in the air in the printing shops was enough to cause symptoms of acute poisoning, but the same levels of pollution did not produce chronic poisoning."

Forni et al[32] (1971) reported the results of a study of changes in the chromosomes of peripheral blood lymphocytes in rotogravure plant workers exposed to concentrations of toluene of 200 ppm throughout most of the work shift and to concentrations well about 200 ppm for very short periods. They found that the group of workers exposed only to toluene for periods of 3 to 15 years showed a somewhat higher rate of unstable chromosome breaks and changes (0.8 and 0.83 percent respectively), compared with the control group (0.61 and 0.67 percent respectively), but that the differences were not statistically significant.

The authors concluded that chronic inhalation of toluene vapor at concentrations of approximately 200 ppm did not significantly affect the rate of chromosome changes in peripheral blood lymphocytes, but cautioned that it would not be appropriate to conclude from this study that prolonged exposure to toluene concentrations of 200 ppm has no toxic effects on chromosomes. Further, comparisons made with a group of control subjects showed that frequencies of chromosome changes were somewhat dispersed, indicating that a different indi-

See Section VI for list of references.

vidual susceptibility to chromosome damage might exist from unknown environmental agents.

Capellini and Alessio [22] (1971) reported results of tests on 17 workers exposed for "several" years to mean atmospheric concentrations of toluene of 125 ppm (range, 80–160 ppm). No changes in the blood picture or liver function were detected in any case. The workers' hemoglobin values, red cell counts, white cell counts, and platelet counts were all within the same limits as 19 control subjects employed in the same plant but having had no exposure to toluene vapor inhalation during their occupational activity. Further, blood findings were within normal limits for one worker employed in another plant area who was exposed to a mean toluene concentration of 250 ppm (range, 210–300 ppm), and who demonstrated symptoms of central nervous system toxicity.

D. *Effects on the Skin.* Dutkiewicz and Tyras [23] (1968) reported the rate of absorption of liquid toluene and aqueous solutions of toluene through the skin of the hands and forearms of nine human volunteers. The authors found that the quantity of toluene absorbed increased with increasing concentration of the hydrocarbon in the aqueous solution. The authors concluded that skin absorption from contact with liquid toluene should be considered in the evaluation of toluene exposure.

Piotrowski [24] (1967) reported on the skin absorption of toluene vapor in three male subjects exposed unclothed for 8 hours in a chamber containing toluene vapor concentrations of 1,600 mg/m (427 ppm). The subjects were protected from inhalation of the toluene vapor by the use of respirators. Analysis of urine samples collected at the end of the exposure period showed no increase in the excretion level of benzoic acid. The author concluded that "one can assume that the possibility of toluene vapor absorption through the skin will not exceed 5 percent of the amount absorbed in the same period of time through the respiratory tract."

Gerarde [25] (1960) stated that liquid toluene is poorly absorbed through intact skin, so that systemic intoxication by percutaneous absorption is highly improbable.

E. *Effects on the Eye.* Carpenter et al [21] (1944) reported mild eye irritation in volunteer subjects exposed to toluene vapor concentrations of 200 ppm for 8 hours.

McLaughlin [26] (1946) reported that workers accidentally splashed with toluene suffered transient disturbances of the eyes, consisting of corneal damage and conjunctival irritation. Complete recovery occurred within 48 hours with no loss of vision.

Capellini and Alessio [22] (1971) reported that one worker exposed to an average of 250 ppm toluene vapor (range, 210–300 ppm) experienced a burning sensation in the eyes. However, the length of the worker's exposure was not specified.

Grant [27] (1962) reported another case of a worker splashed with a solution of stearic acid in toluene who experienced only transient epithelial injury. The subject felt immediate, severe, burning pain and had involuntary blepharospasm. However, although the eyes were not irrigated until 4 to 5 minutes after the accident, only moderate conjunctival hyperemia and corneal epithelial edema resulted, with a complete recovery within 2 days.

F. *Other Effects.* Greenburg, et al [7] (1942) found enlarged livers in 13 out of 61 painters exposed to concentrations of toluene ranging from 100 to 1,100 ppm. However, only the number of workers exposed at each level of toluene was presented in the report, and no comparison could be made between the incidence of liver enlargement and the degree of toluene exposure. The hepatomegaly was three times the frequency observed in the control group of 430 workers having no exposure to toluene.

O'Brien et al [28] (1971) described a case of hepatorenal damage from chronic exposure to toluene vapor in a 19-year-old male glue-sniffer. After three years, the toluene caused serious, but apparently reversible, injury to the kidneys and liver. The principal component of the solvent inhaled by the patient was toluene (80 percent v/v), but the other constituents were not mentioned in the report. During the patient's hospitalization following a severe episode of toluene exposure, however, the concentration of toluene in the serum was found to be 180 ppm.

III. Pertinent Legal Authority

The primary purpose of the Act is to assure so far as possible safe and healthful working conditions for every working man and woman. One means prescribed by Congress to achieve this goal is the authority vested in the Secretary of Labor to set mandatory safety and health standards. The standards setting process under section 6 of the Act is an integral part of an occupational safety and health program in that the process permits the participation of interested parties in consideration of medical data, industrial processes and other factors relevant to the identification of hazards. Occupational safety and health standards provide notice of the requisite conduct or exposure level and provide a basis for ensuring the existence of safe and healthful workplaces.

The Act provides that:

> The Secretary, in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life. Development of standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate.
>
> In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. [Section 6(b)(5).]

Sections 2(b)(5) and (6), 20, 21, 22, and 24 of the Act reflect Congress' recognition that conclusive medical or scientific evidence including causative factors, epidemiological studies or dose-response data may not exist for many toxic materials or harmful physical agents. Nevertheless, standards cannot be postponed because definitive medical or scientific evidence is not currently available. Indeed, while final standards are to be based on the best available evidence, the legislative history makes it clear that "it is not intended that the Secretary be paralyzed by debate surrounding diverse medical opinion." [House Committee on Education and Labor, Report No. 91–1291, 91st Cong., 2nd Session, p. 18 (1970).] This Congressional judgment is supported by the courts which have reviewed standards promulgated under the Act. In sustaining the standard for occupational exposure to vinyl chloride (29 CFR 1910.1017), the U.S. Court of Appeals for the Second Circuit stated that "It remains the duty of the Secretary to act to protect the working man, and the act even in circumstances where existing methodology or research is deficient." ["The Society of the Plastics Industry, Inc. v. United States Department of Labor," 509 F. 2d 1301 (2d Cir. 1975), *cert den*, "Firestone Plastics Co. v. United States Department of Labor," —— U.S. ——, 95 S.Ct. 1998, 44 L.Ed.2d 482 (May 27, 1975).]

A similar rationale was applied by the U.S. Court of Appeals for the District of Columbia in reviewing the standard for occupational exposure to asbestos (29 CFR 1910.1001). The Court stated:

> Some of the questions involved in the promulgation of these standards are on the frontiers of scientific knowledge, and consequently as to them insufficient data is presently available to make a fully informed factual determination. Decision-making must in the circumstance depend to a greater extent upon policy judgments and less upon purely factual judgments.

["Industrial Union Department, AFL–CIO v. Hodgson," 499 F. 2d 467, 474 (D.C. Cir. 1974).]

In setting standards, the Secretary is expressly required to consider the feasibility of the proposed standards. [Senate Committee on Labor and Public Welfare, Report No. 91–1282, 91st Cong., 2d Sess., p. 58 (1970).] Nevertheless, considerations of technological feasibility are not limited to devices already developed and in use. Standards may require improvements in existing technologies or require the development of new technology. ["The Society of the Plastics Industry, Inc. v. United States Department of Labor," 509 F. 2d 1309 (2d Cir. 1975), *cert den*, "Firestone Plastics Co. v. United States Department of Labor," —— U.S. ——, 95 S.Ct. 1998, 44 L.Ed.2d 482 (May 27, 1975).]

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Where appropriate, the standards are required to include provisions for labels or other forms of warning to apprise employees of hazards, suitable protective equipment, control procedures, monitoring and measuring of employee exposure, employee access to the results of monitoring, and appropriate medical examinations or other tests, they must be made available at no cost to the employee [Section 6(b)(7)]. Standards may also prescribe recordkeeping requirements where necessary for appropriate enforcement of the Act or for developing information regarding occupational accidents and illnesses [Section 8(c)].

IV. Proposal

In the development of this proposal, OSHA has considered recommendations contained in the document "Criteria for a Recommended Standard * * * Occupational Exposure to Toluene," which was developed for the Secretary of Labor by the National Institute for Occupational Safety and Health (NIOSH), Department of Health, Education, and Welfare, public comments on the NIOSH document received in response to an OSHA advance notice of proposed rulemaking (38 FR 30452), as well as numerous reference works, studies, case histories, and journal articles which are included in the references section of this notice.

The following discussion analyzes significant provisions of the proposed standard for occupational exposure to toluene.

A. *Scope and Application.* The proposed standard would apply to all employers in all industries, including construction and maritime as well as "general industry," over which OSHA has jurisdiction, having establishments in which toluene is produced, released, packaged, repackaged, stored, handled, used, or transported. Although the scope of this proposal, is broad, covering nearly every industrial use or handling of toluene, the specific provisions of the proposed standard that would apply to any particular employer depend upon the amount of the toxic substance actually released into the workplace air or upon whether employees are likely to have skin contact with liquid toluene.

B. *Exposure Limits—Permissible Airborne Exposure Limits.* The proposed standard sets an 8-hour time-weighted average limit (TWA) of 100 parts of toluene per million parts of air (ppm) and a ceiling limit of 200 ppm in place of the 200 ppm TWA and 300 ppm ceiling limit currently listed in § 1910. 1000, Table Z-2. The proposed ceiling limit prescribes a 15-minute sampling period which is not included in the current standard. The proposal contains no specific provision for peak concentrations. The proposed exposure limits are considered by OSHA to provide the minimum protection against material impairment of employees occupationally exposed to toluene.

The proposed reduction of the TWA limit from 200 to 100 ppm is based upon the results of studies of controlled 8-hour exposures of human subjects to purified toluene in air. Concentrations of 200 ppm have been shown to produce mild fatigue, muscular weakness, impaired coordination, moderate dilation of the pupils and paresthesia of the skin in some subjects. These symptoms are more pronounced at higher concentrations. They are absent, however, at 100 ppm with the exception of mild fatigue, which has been seen in the studies even in the control groups at levels of zero ppm. Thus, in agreement with NIOSH recommendations, OSHA believes that the reduction of the TWA limit is essential to the satisfactory mitigation of the effects of acute exposure.

Reduction of the ceiling concentration limit to 200 ppm in the proposed standard is supported by evidence in the literature that fatigue, dizziness, exhilaration and mental confusion have resulted from exposures of subjects to concentrations of 200 ppm for periods of less than 8 hours.

OSHA has determined that the concept of peak excursion level may not be appropriate in its regulations on toluene. The present peak excursion level and duration, which are part of the ANSI Z37 standard adopted by OSHA, were based on a judgment by the ANSI Z37 Committee, and are not supported by evidence in the scientific literature. Therefore, OSHA has decided that the peak excursion concept should be deleted from the proposed standard.

Dermal and Eye Exposure Limits. As in the case of most organic solvents, liquid toluene acts as a defatting agent on the skin tissues, resulting in irritation and dermatitis. Repeated or prolonged exposures may even result in skin burns. Eye contact with liquid toluene causes severe pain and irritation and, unless flushed out promptly with water, may result in corneal burns. For these reasons, the proposed standard would prohibit employers from exposing employees to eye contact and repeated and/or prolonged skin contact with liquid toluene.

C. *Action level.* In addition to time-weighted average and ceiling limits, the proposed standard prescribes an action level which is a concentration of toluene equal to one-half of the TWA, at or above which certain precautionary measures such as exposure measurements and medical surveillance must be initiated.

The proposed action level for toluene is any concentration greater than or equal to 50 parts per million (50 ppm). Like the TWA, the action level is based on an 8-hour time-weighted average.

In OSHA's judgment, two kinds of uncertainties can affect an employer's efforts to be reasonably confident of the results of his exposure measuring program. First, he must know if his sampling and analysis accurately informs him of his employee's actual exposure level on the day of measurement. Assuming that an employee's exposure has been properly measured (excluding such things as precision and accuracy of the sampling method) an employer can be reasonably sure of the employee's exposure on the day of measurement.

Second, the employer must also know whether the measured exposure level on one day is indicative of exposure levels on days he does not measure. It is known that the level of contamination in occupational environments varies from day to day in a random fashion. This variation in levels is unavoidable; is only minimally connected to the precision and accuracy of the method of measurement, and does not include variations due to changes in work processes or controls.

OSHA has statistically determined that at any measurement exposure level below the permissible limit. (Leidel, N. A., Busch, K. A. *et al.*, "Exposure Measurement Action Level and Occupational Environmental Variability," [DHEW, PHS, CDC, NIOSH, DLCD (August 1975). Above one half the permissible limit, i.e. the action level, the statistical risk is such that an employer cannot reasonably be confident that his employees may not be overexposed. Therefore, requiring exposure measurements to begin at the action level provides the employer with a reasonable degree of confidence in the results of his measurement program.

In view of these considerations and in order to provide maximum employee protection, the proposal would also require the employer to commence medical surveillance and employee training programs at the action level.

D. *Determination and measurement of exposures.* The employer would be required to make an initial determination of employee exposure to airborne or liquid toluene. This determination may be an observation based on the amount of toluene in use, the types of operations being performed, the amount and type of ventilation, and the proximity of employees to the sources of emission. The employer must also consider any employee complaints of symptoms that may be attributable to toluene exposure.

When making the initial determination of employee exposure, the employer is not required to take actual samples or measurements of airborne concentrations of toluene vapor. However, if the employer has taken any measurements, these must also be considered in the determination. In making the determination, the employer should be certain that the determination reflects employee exposure conditions over the entire work day.

In establishments having more than one work operation involving the use of toluene, an initial determination must be made for each operation. A new initial determination must be made whenever there is a change in production process or control measures which could result in new or additional exposures, or whenever the employer has any other reason to suspect that a change in exposure condition has occurred.

If the results of the initial determination are negative, that is, if the employer determines that no employee is exposed to potential skin or eye contact with liquid toluene, or to concentrations of toluene vapor at or above the action level or above the ceiling limit, a written

See Section VI for list of references.

record of this determination must be made. This record must contain any information and observations that indicate possible employee exposure including employee complaints of symptoms that may be attributable to such exposure. Further, the determination record must include any measurements of toluene that have been made (although none are required to be made for the initial determination), and the names and social security numbers of the employees considered under the determination.

When results of the initial determination of dermal or eye exposure indicate that any employee may be exposed by skin or eye contact with liquid toluene, the employer would be required to provide affected employees with impermeable protective clothing and devices to protect the area(s) of the body likely to come in contact with liquid toluene.

If the initial determination of exposure to airborne concentrations indicates that an employee may be exposed to vapor concentrations at or above the action level, or in excess of the ceiling limit, the employer would be required to measure the exposure of the employee believed to have the greatest exposure. Because a positive determination indicates possible exposure in excess of either the action level or ceiling limit, thus triggering the exposure measurement program, with its own recordkeeping requirements, no written records of positive determinations need be made.

When the results of the single employee's exposure measurement reveal exposures in excess of the action level or the ceiling limit, the employer would be required to identify all other employees who might be similarly exposed, and to measure the exposures of each of these employees. The proposed standard contains detailed instructions for monitoring the exposure of such employees.

The measurement procedure may be terminated if the measured single employee exposure does not indicate exposures in excess of the action level or ceiling limit. However, it should be noted that if an employer has knowledge of a production, process or control change which could result in increased exposures to toluene, or if the employer has any other reason to suspect that a change in exposure conditions has occurred, the determination procedure must be repeated.

The monitoring provisions are designed so that employers having workplaces in which the use of toluene is controlled by engineering or work practices, to the extent that exposures are below the action level, would not be required to make continuous measurements. Further, those employers having establishments with exposures at or above the action level, but below the permissible exposure limits, would be required to make only the minimum number of exposure measurements necessary for protection of employees. The intent of these procedures is to provide adequate protection for employees while minimizing the burden on employers.

See Section VI for list of references.

E. *Methods of Measurements.* The proposal would require that exposure measurements reflect the actual exposure conditions for each employee. No specification is made for the location of the samples taken. Thus, the employer is free to choose to perform either personal, breathing zone, or general air samples, provided that the method chosen gives an accurate indication of the employees' exposures. Further, any appropriate combination of long-term or short-term samples would be acceptable. However, the proposal requires that all exposures be calculated on an eight-hour time-weighted average basis, with the exception of the ceiling concentration measurements.

The sampling method must have an accuracy, to a 95 percent confidence level, of ±35 percent up to 100 ppm and ±25 percent above 100 ppm. The term "accuracy" refers to the difference between the measured value and the true concentration. It allows for both the random variation of the method (its precision) and the difference between the average result and the true value (bias of the method). As noted, the required accuracy for concentrations of toluene above 100 ppm is 25 percent at a 95 percent confidence level. This means that out of a large series of measurements, 95 percent must be within 25 percent of the true value.

F. *Methods of compliance.* The proposed standard would require the employer to immediately institute engineering controls to reduce employee exposures to or below the 100 ppm TWA, and to or below the ceiling limit, except in situations where such controls are infeasible. Further, in situations where the engineering controls that can be instituted immediately will not reduce exposures to the TWA and to the ceiling limit, they must nonetheless be used to reduce exposures to the lowest practicable level, and be supplemented by the use of work practices.

Where engineering controls and work practices combined will not reduce exposures to the time-weighted average and to the ceiling limit, they must be further supplemented by personal protective devices.

A program must be established and implemented to reduce exposures to within the permissible exposure limits, or to the greatest extent feasible, solely by means of engineering controls. Written plans for such a program shall be made available for examination and copying to representatives of the Secretary and the Director. These plans must be reviewed and updated as necessary to reflect the current status of exposure control.

Engineering controls are the preferred means of compliance because they reduce exposure hazards in the workplace environment by removing the airborne contaminants. Engineering controls may include the installation of local exhaust ventilation or the modification of a process so as to reduce emission of the toluene into the workplace. When mechanical ventilation is used for engineering control, checks of air system efficiency such as capture velocity, duct velocity or static pressure must be made at least every three months. These checks are necessary to assure that the primary control system (mechanical ventilation) is functioning effectively at all times.

When engineering controls prove to be infeasible or inadequate, work practice controls must then be used to supplement them. Work practice controls include, for example, adherence to proper process techniques and proper maintenance. It should be noted that effective work practice controls often require the maintenance of strong supervisory control.

Where both engineering and work practice controls are infeasible or insufficient to reduce the exposure to permissible levels, they must be supplemented by the use of respirators. Respirators are the least satisfactory means of control because of certain difficulties inherent in their use. Respirators are capable of providing good protection only if they are properly selected for the concentrations of airborne contaminants present, properly fitted to the employee, properly worn by the employee, and replaced when they have ceased to provide protection. Although it is theoretically possible for all of these conditions to be met, it is more often the case that they are not, and, as a consequence, the protection of employees by respirators is not as effective as the other methods of compliance.

G. *Hazardous Operations.* In addition to the hazard from inhalation of the vapors, toluene is highly flammable and its vapors form explosive mixtures in air. Good ventilation is essential in rooms or areas where toluene is handled to prevent accumulations of toxic or explosive mixtures. Reaction vessels and storage tanks which have been emptied for cleaning, maintenance or inspection may contain toluene vapors which are immediately hazardous. For this reason, the proposed standard cross-references § 1910.94(d)(11)(ii)–(v) which contain provisions for safe entry into reaction vessels or storage tanks.

H. *Employee Information and Training.* Information and training are essential for the protection of employees, because an employee can do much to protect himself if he is informed of the nature of the hazards in his workplace. To be effective, an employee education system must apprise the employee of the specific hazards associated with his work environment. For this reason, the employer must inform each employee, in detail, about the nature of toluene-related health problems, the necessity for exposure control and the medical and industrial hygiene monitoring programs. Further, the employee must be instructed to report promptly the development of symptoms or conditions which could be attributed to overexposure to toluene. Because information and training are so important to employees, this section of the proposal must be observed even if the initial determination or exposure measurements indicate exposures to be below the action level.

I. *Medical surveillance.* The proposed standard would require employers to institute a program of medical surveillance for employees who have been or will be exposed to concentrations of toluene vapor at or above the action level or in excess of the ceiling limit. As in the case of exposure determinations, the level of an employee's exposure is considered without regard to the use of respirators. The purpose of the medical surveillance requirements is to protect the employee from exposure to concentrations of toluene which may be above his own level of tolerance, and to ensure that if symptoms of overexposure do occur, they are recognized as early as possible in order that appropriate action can be taken.

The proposal calls for a medical examination which includes pulmonary function testing, urinalysis, and a complete blood count. Toluene is used as a component in many organic solvent mixtures and overexposure to many organic solvents has been shown to have the potential for causing liver and kidney impairments. Thus, the urinalysis is useful for screening for individuals who have, or may develop, liver or kidney dysfunctions. Such individuals are often excluded from working in areas where toluene is released to prevent further damage to these organs. Pulmonary function testing is necessary for determining whether an employee is able to wear certain types of respiratory protective equipment.

Although the proposal specifies the types of medical tests and examinations to be given affected employees, the employer may allow the examining physician to use other types of medical examinations, provided the alternative procedures can give at least equal assurance of detecting medical conditions pertinent to protecting employees against the health hazards associated with toluene exposure. If the employer accepts such alternative medical examinations, the employer must obtain a statement from the physician setting forth the alternative medical examinations to be used and the rationale for their substitution. The employer must also inform affected employees that medical examinations other than those prescribed in the standard are to be made available.

The employer must provide the examining physician with a copy of the standard for toluene including the appendices; a description of the employee's duties; a description of any personal protective equipment used by the employee; the results of the employee's exposure measurement; and an estimate of the levels to which the employee will be exposed. The employer must also provide any available employee medical history information requested by the physician.

Following the medical examination, the employer must obtain a written opinion from the examining physician stating whether the employee has any medical condition that would place him at increased risk to his health, or that would be aggravated through exposure to toluene. Additionally, the opinion must state any recommended limitations upon the employee's exposure or upon the employee's use of respirators and other protective equipment. The opinion must also state that the employee has been informed of any medical conditions which require further examination or treatment, although the written opinion must not contain specific findings or diagnoses unrelated to the employee's exposure to toluene. The employer must provide a copy of the physician's opinion to the affected employee.

If, based on the physician's opinion, the employer determines that exposure of an employee to toluene would impair the employee's health, the employer must then provide that the employee is not exposed to levels of toluene which may place him/her at increased risk.

Refusal of Medical Examination. The proposed standard also contains a procedure to be followed by the employer in the event that an employee refuses to undergo any medical examination which must be offered pursuant to § 1910.1029 (n). This procedure involves informing the employee of the potential risk that is incurred by his refusal to be examined, and obtaining a signed statement from the employee attesting to the fact that the employee fully understands the potential risk, but still does not wish to be examined.

It is not OSHA's intent to encourage employees to avoid medical examinations. Rather, OSHA believes that positive action must be taken by employers to inform employees of the risks involved in refusing to be examined, and that employees should be encouraged to undergo the examinations required by this proposed standard.

J. *Recordkeeping.* The proposed standard would require employers to keep written records of the following: Initial determinations which indicate that employees are not exposed at or above the action level or above the ceiling limit; measurements of employee exposure; tests of mechanical ventilation system efficiency (where such systems are used for engineering control); annual training and information sessions; medical examinations; and pre-placement histories.

Besides showing that an employer has made an examination of the workplace, records of negative determinations also assist the employer in pinpointing areas of his operations where there might be potential for exposure above the action level in the future. Records of initial positive determinations, however, are not needed, because a positive determination requires the employer to take other actions which carry their own recording requirements.

When symptoms of organic damage appear, a physician often needs information as to the patient's previous medical conditions to make an accurate diagnosis of the problem and its apparent cause. Records of previous occupational medical examinations could be an invaluable aid to the physician treating a patient with organic damage which may be due to exposure to a toxic chemical substance. For this reason, the proposal would require the employer to retain records of employee exposure measurements and medical examinations for a period of no less than 10 years, even if the employee ceases to work for the employer.

A record of the tests of mechanical ventilation system efficiency is required to be maintained so that the employer can ensure that tests of the system are being made at the required time intervals. Further, the record is useful to the employer, since comparison of the most recent test with previous tests will assist in the evaluation of the effectiveness of the ventilation system, and will enable the employer to detect any progressive loss of efficiency before it becomes critical.

Section 8(c)(3) of the Act requires, and paragraph (o) of this proposal contains provisions for access to records of exposure measurements by employees and former employees or their representatives, and for access to medical records made pursuant to paragraph (n) by physicians designated by employees or former employees. It should be noted that such access is limited only to the records of determinations, exposure measurements, and medical examinations that are being maintained by the employer in accordance with the recordkeeping requirements. It should also be noted that the employer is not required to retain or make those records accessible for periods longer than those required in paragraph (o) of the proposed standard.

The proposal provides for the transfer of monitoring and medical records, when: (1) One employer succeeds another, and (2) an employer ceases to do business and there is no successor. An employer succeeding another is merely required to receive and maintain those records which his predecessor would have been required to keep. Employers closing out their businesses without successors are required to send their records to NIOSH and notify each employee and former employee of the transfer.

OSHA is aware that certain provisions of this proposal, such as medical surveillance and the extended retention period for medical monitoring records may pose special problems to some employers, especially those who have small numbers of employees, operate with non-fixed places of employment, or use workforces which are highly transient in nature.

This awareness has been expressed by the Department of Labor in a statement submitted to the House Subcommittee on Environmental Problems Affecting Small Business on 26 June 1975, as follows: "It has become increasingly evident that the combined body of Federal regulations imposes a substantial, and, to some extent, unnecessary burden upon employers, particularly those who run small businesses. While most of these requirements serve a necessary and useful purpose, a definite potential exists for duplication, conflicting standards, and inappropriate recordkeeping requirements. In an effort to eliminate problems where any exist in the Department of Labor, I have re-

See Section VI for list of references.

quested my agency heads to assess the small business impact of the laws they administer and determine what can be done to ease the burden on the small employer, while still assuring compliance with the law."

Although it is clear that OSHA's first and prime responsibility is to assure employee safe and healthful places of employment, the Act and its legislative history recognize that economic and technological feasibility are legitimate factors to be considered in the setting of occupational safety and health standards.

In addition, the Act explicitly takes cognizance of its impact upon affected small business, specifically with respect to any recordkeeping requirements which are imposed.

Pursuant to section 8(d) of the Act, OSHA is exploring methods of reducing, to the maximum extent possible, the administrative and economic burdens of the proposal's various recordkeeping requirements.

While the proposal does not address itself to specific alternatives, OSHA invites comments concerning options which would both provide full protection to affected employees and at the same time would minimize the administrative and economic burden on affected employers —especially those with small numbers of employees, non-fixed workplaces, or highly transient workforces.

K. *Observation of monitoring.* Section 8(c)(3) of the Act requires employers to provide employees or their representatives with the opportunity to observe monitoring of employee exposures to toxic materials or harmful physical agents. In accordance with this section, the proposed standard provides for such observation. To ensure that this observation of monitoring is meaningful, observers would be entitled to receive an explanation of the measurement procedure, to observe all steps related to the measurement procedure, and to record the results obtained.

It should be noted that the observer, whether an employee or designated representative, must be provided with and is required to use any personal protective devices required to be worn by employees working in the area that is being monitored, and must comply with all other applicable safety procedures.

L. *Appendices.* Three appendices have been included in this proposal: Appendix A, "Substance Safety Data Sheet;" Appendix B, "Substance Technical Guidelines;" and Appendix C, "Medical Surveillance Guidelines."

The appendices are not to be construed as mandatory requirements in and of themselves. They are included with the regulation to provide information to employers and employees, and to assist in compliance with the provisions of the toluene standard. The information contained in Appendices A and B is to be provided to employees as part of the annual training and education program.

Appendix C gives the employer a means of providing the examining physician with an explanation of the potential health effects of toluene exposure, and provides information needed by the physician to make an accurate interpretation of the medical examination results. Appendix C also lists other types of examinations, not required by the standard, which may help the physician in making an accurate determination of whether an employee should be exposed or should continue to be exposed to toluene.

V. Environmental Impact Assessment

The National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321–4347), requires, among other things, that Federal agencies assess their proposed major actions, including rulemaking, to determine whether a significant impact of the quality of the human environment may result. Furthermore, 29 CFR 1999.3 (d) requires that where OSHA determines that an environmental impact statement should be prepared, the determination to do so must be published in the Federal Register. Accordingly, it is hereby noticed that OSHA intends to prepare an environmental impact statement on the proposed standard for occupational exposure to toluene in accordance with the requirements of 29 CFR Part 1999.

Once the draft environmental impact statement has been prepared, a copy of it will be made available by OSHA to any member of the public who requests an opportunity to comment on it. Any person or agency submitting comments on it to OSHA must at the same time forward five copies of the comments to the Council on Environmental Quality (CEQ), 722 Jackson Place NW., Washington, D.C. A 45-day period will be allowed for the submission of comments after the publication of the notice of availability of the draft environmental impact statement. The draft statement will be available, where practicable, at least 15 days prior to a public hearing on the proposed standard. The environmental impact of the proposal would be an appropriate issue at such hearing.

It appears at present that the preceding preamble to the proposed standard for occupational exposure to toluene adequately assesses the impact of the proposal on the workplace environment. It further appears that the proposed standard for occupational exposure to toluene will have no significant effects on the quality of the human environment external to the workplace. The proposal does not increase the amount of toluene permitted to be released into the ambient air, nor does the proposal call for changes of industry practice in disposal of toluene waste. For these reasons, OSHA does not anticipate any increased impact on the community contiguous to establishments in which toluene is used or produced.

Interested persons may submit comments that may be helpful in preparing the draft environmental impact statement on the proposed standard. Any person having relevant information or data not readily available in the open literature is invited to submit it to David R. Bell, Office of Standards Development, Occupational Safety and Health Administration, U.S. Department of Labor, 200 Constitution Avenue NW., Room N3669, Washington, D.C. 20210, by November 5, 1975. Comments submitted in regard to the proposed standard need not be resubmitted. All material received on environmental impact will be available for public inspection and copying at the above address.

VI. Notes and References

The studies discussed herein represent the primary sources upon which the proposed toluene standard is based. The discussion does not include all studies and source materials which OSHA has considered in the development of this proposal. A complete list of references is available for inspection and copying at the OSHA Technical Data Center, Room N3620, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, D.C. 20210.

References

[1] Cler HE: Toluene, in Kirk RE, Othmer DF (eds.): Encyclopedia of Chemical Technology. ed 2. New York, Interscience Publishers, 1969, vol. 20, pp. 257–65.

[2] 1970 chemical production data. Chem Eng News, May 5, 1975.

[3] Erskine MG: Chemical Economics Handbook, Organic Chemicals P–Z, 696.503D. Menlo Park, California, Stanford Research Institute, 1967.

[4] Occupational Health Survey of the Chicago Metropolitan Area. Cincinnati, U.S. Department of Health, Education, and Welfare, Public Health Service, Bureau of Occupational Safety and Health, 1970.

[5] Oettingen WF von, Neal PA, Donahue DD: The toxicity and potential dangers of toluene—Preliminary report. J.A.M.A. 118: 579–84, 1942.

[6] Oettingen WF von, Neal PA, Donahue DD, Svirbely JL, Baernstein HD, Monaco AR, Valaer PJ, Mitchell JL: The toxicity and potential dangers of toluene with special reference to its maximal permissible concentration, Bulletin 279. Public Health Service, 1942.

[7] Greenburg L, Mayers MR, Heimann H, Moskowitz S: The effects of exposure to toluene in industry. J.A.M.A. 118:573–78, 1942.

[8] American National Standards Institute: Acceptable Concentration of Toluene Z37.12–1967, New York, 1969.

[9] American National Standards Institute: Acceptable Concentrations of Toluene Z37.12–1974, New York, 1974.

[10] Wilson RH: Toluene Poisoning, J.A.M.A. 123:1106–08, 1943.

[11] Transactions of the Ninth Annual Meeting of the American Conference of Governmental Industrial Hygienists, Cincinnati, 1947, p. 44.

[12] Threshold Limit Values of Airborne Contaminants and Physical Agents with Intended Changes Adopted by ACGIH for 1971. American Conference of Governmental Industrial Hygienists, Cincinnati, 1971.

[13] Hygienic Guide Series, Toluene. American Industrial Hygiene Association, Hygienic Guide Committee, 1957.

[14] Manufacturing Chemists' Association: Chemical Safety Data Sheet SD–63 Toluene. Washington, D.C., 1956.

[15] Pagnotto LD, Lieberman LM: Urinary Hippuric Acid excretion as an index to toluene exposure. Am. Ind. Hyg. Assoc. J. 28:129–34, 1967, 1956.

[16] Ikeda M, Imamura T: Biological Half-life of Trichloroethylene and Tetrachloroethylene in Human Subjects. Int. Arch. Arbeitsmed. 31, 209–224, 1973.

[17] Ogata M, Tomokuni K, Takatsuka Y: Urinary excretion of hippuric acid and m- or p-methylhippuric acid in the urine of persons exposed to vapours of toluene and m- or p-xylene as a test of exposure. Br. J. Ind. Med. 27:43–50, 1970.

[18] Bakke, O.M., Scheline, R.R.: Hydroxylation of Aromatic Hydrocarbons in the Rat. Toxicol Appl Pharmacol. 16:691–700, 1970.

[19] Knox JW, Nelson JR: Permanent Encephalopathy from Toluene Inhalation; N. Engl. J. Med. 275:1494–96, 1966.

[20] Baker AB, Tichy FV: Effects of Organic Solvents and Industrial Posonings on Central Nervous System; A. Research Nerv. and Ment. Dis. Proc., 32:475–505, 1953.

[21] Carpenter CP, Shaffer CB, Weil CA, and Smyth HF, Jr: Studies on the Inhalation of 1,3-Butadiene; with a comparison of its narcotic effect with benzol, toluol, and styrene, and a note on the elimination of styrene by the human. J. Ind. Hyg. Toxicol 26:69–78, 1944.

[22] Capellini A, Alessio L: [The Urinary Excretion of Hippuric Acid in Workers Exposed to Toluene.] Med. Lavoro 62:196–201, 1971 (It).

[23] Longley EO, Jones AT, Welch R, and Lomeav O: Two Acute Toluene Episodes in Merchant Ships. Arch. Environ. Health 14: 48187, 1967.

[24] Satran R, Dodson VN: Toluene Habituation—Report of a Case. N. Engl. J. Med. 268: 719–21, 1963.

[25] Gusev IS: Reflective Effects of Microconcentrations of Benzene, Toluene, Xylene and Their Comparative Assessment. Hyg. Sanit. 30:331–35, 1965.

[26] Francone MP, Braier L: [The basis for the substitution of benzen by the higher homologues in industry.] Med. Lavoro 45:29–32, 1954 (It).

[27] Parmeggiani L, Sassi C: [Occupational Risk of Toluene: Environmental Studies and Clinical Investigations of Chronic Intoxication.] Med. Lavoro 45:574–93, 1954 (It).

[28] Banfer W: [Studies on the Effect of pure Toluene on the blood picture of Photogravure Printers and Helper workers.] Zentralbl Arbeitsmed 11:35–40, 1961 (Ger).

[29] Bansagi J: [Effect of Toluene on the Phagocytic Activity of White Blood Cells in Printers.] Munkavedelem 14:26–28, 1968 (Hun).

[30] Cieslinska A, Kowal-Gierczak B, Kuczynska-Sekieta K, Malolepszy J, Wrzyszcz M [Serum iron and copper levels in subjects with chronic Toluene exposure.] Pol Tyg Lek 24:1848–50, 1969 (Pol).

[31] Pacseri I, Emszt G; [Medical aspects of the Exposure to Toluol.] Munkavedelem 16: 41–46, 1970 (Hun).

[32] Forni A, Pacifico E, Limonta A: Chromosome Studies in Workers Exposed to Benzene or Toluene or both. Arch Environ. Health 22:373–78, 1971.

[33] Dutkiewicz T, Tyras H: The quantitative estimation of toluene skin absorption in man. Arch Gewerbepath Gewerbehyg 24: 253–57, 1968.

[34] Piotrowski J: [Quantitative estimate of the Absorption of Toluene in people.] Med. Pracy 18:213–23, 1967 (Pol).

[35] Gerarde HW: Toxicology and Biochemistry of Aromatic Hydrocarbons. New York, Elsevier Publishing Co., 1960, pp. 141–50.

[36] McLaughlin RS: Chemical Burns of the Human Cornea. Am. J. Ophthalmol 29:1355–62, 1946.

[37] Grant WM: Toxicology of the Eye. Springfield, Ill., Charles C. Thomas, 1962, pp. 544–45.

[38] O'Brien ET, Yeoman WB, Hobby JAE: Hepatorenal damage from toluene in a "glue sniffer." Br. Med. J. 2:29–30, 1971.

VII. Public Participation

Interested persons wishing to submit data, views, arguments, or other comments concerning the proposal should mail an original and four clear copies of these materials to the U.S. Department of Labor, Occupational Safety and Health Administration, Docket Officer, Docket H–026, Room N3620, 200 Constitution Avenue NW., Washington, D.C. 20210, by December 5, 1975. The data, views, arguments, and other comments will be available for public inspection and copying in the Office of Standards Development.

Pursuant to 29 CFR 1911.11 (b) and (c), interested persons may, in addition to filing written matter as provided above, file objections to the proposal requesting an informal hearing with respect thereto in accordance with the following conditions:

(1) The objections must include the name and address of the objector;

(2) The objections must be postmarked on or before December 5, 1975.

(3) The objections must specify with particularity the provision of the proposed rule to which objection is taken, and must state the grounds therefor;

(4) Each objection must be separately stated and numbered; and

(5) The objections must be accompanied by a summary of the evidence proposed to be adduced at the requested hearing.

In addition to the comments and objections invited above concerning the proposal and its environmental impact, OSHA hereby solicits comments from interested parties regarding the potential inflation impact of the proposed standard. Comments must be submitted in accordance with the above requirements for comments on the proposal and may be directed toward any or all of the following subjects:

1. Cost impact on consumers, businesses, markets, or Federal, State, or local government;

2. Effect on the productivity of wage earners, businesses, or government;

3. Effect on competition;

4. Effect on supplies of important materials, products, or services;

5. Effect on employment; and

6. Effect on energy supply or demand.

It is OSHA's intention to prepare an inflation impact statement and analysis, if appropriate, or a certification that the standard has no substantial inflationary impact, and to make such statement or certification available at least 30 days prior to any public hearings on the proposed standard. The potential inflationary impact of the proposed standard would be an appropriate issue at such hearings.

This procedure has been concurred in by the Council on Wage and Price Stability in accordance with the Office of Management and Budget Circular A–107 (28 January 1975), issued pursuant to Executive Order 11821 (27 November 1974) (39 FR 41501).

Accordingly, pursuant to sections 4(b), 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1592, 1593, 1599; 29 U.S.C. 653, 655, 657) and 29 CFR Part 1911, it is hereby proposed to amend Part 1910 of Title 29 of the Code of Federal Regulations as set forth below.

Signed in Washington, D.C. this 29th day of September, 1975.

John T. Dunlop,
Secretary of Labor.

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. Table Z–2 in § 1910.1000 is proposed to be amended by deleting the following:

* * * * *

Toluene ------ 200 ppm ------ 300 ppm ------ 500 ppm 10 minutes (Z37.12–1967).

* * * * *

2. A new § 1910.1029 is proposed to be added to Part 1910 of Title 29 of the Code of Federal Regulations, reading as follows:

§ 1910.1029 Toluene.

(a) *Scope and application.* (1) This section includes requirements for the control of employee exposure to toluene.

(2) This section applies to the production, release, packaging, repackaging, storage, transportation, handling or use of toluene except that this section will not apply to working conditions with respect to which any other Federal agency has exercised statutory authority to prescribe or enforce standards or regulations affecting occupational safety and health hazards covered by this section.

(b) *Definitions.* "Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, or his designee.

"Emergency" means any occurrence such as, but not limited to equipment failure, rupture of containers, or failure of control equipment which is likely to, or does result in the unexpected release of toluene in excess of the ceiling limit.

"Hazardous operation" means any operation, procedure or activity where a release of toluene might occur, either as a consequence of the operation or because of an accident in the operation, which would result in employee exposure in excess of the ceiling limit, or in repeated skin contact with liquid toluene.

"Secretary" means the Secretary of Labor, or his designee.

(c) *Exposure limits*—(1) *Permissible exposure limits*—(i) *Time-weighted average limit (TWA).* Employers shall ensure that no employee is exposed to an 8-hour time-weighted average of toluene in excess of 100 parts per million parts of air (100 ppm), based on a 40-hour week.

(ii) *Ceiling limit.* Employers shall ensure that no employee is exposed to an airborne concentration of toluene in excess of 200 parts per million parts of air (200 ppm) as averaged over any 15 minute period during the working day.

(2) *Dermal and eye exposure limit.* Employers shall ensure that no employee will have eye or repeated or prolonged skin contact with liquid toluene.

(d) *Action level.* Action level means a concentration of toluene of 50 parts per million parts of air (50 ppm) as determined on an 8-hour time-weighted average basis.

(e) *Determination and measurement of exposure*—(1) *Determination of requirement for measurement.* Each employer who has a place of employment in which toluene is present shall inspect each workplace and work operation to determine if any employee may be exposed, without regard to the use of respirators, to airborne concentrations of toluene at or above the action level or in excess of the ceiling limit, or to skin or eye contact with liquid toluene. Such a determination shall be based on the following, along with any other relevant considerations:

(i) Any information, observations, or calculations which would indicate employee exposure to toluene;

(ii) Any measurements of airborne toluene; and

(iii) Any employee complaints of symptoms which may be attributable to exposure to toluene.

(2) *Negative determination.* When a determination is made that no employee is exposed to airborne concentrations of toluene at or above the action level or in excess of the ceiling limit, or by skin or eye contact with liquid toluene, the employer shall make a record of such determination. This record shall include at least the information specified in paragraph (e)(1) of this section, and shall also include the date of the determination, work being performed at the time, location within the work site, and the names and social security numbers of employees considered.

(3) *Positive determination.* When a determination conducted under paragraph (e)(1) of this section indicates the possibility of any employee exposure to airborne concentrations of toluene at or above the action level or in excess of the ceiling limit, without regard to the use of respirators, the employer shall measure the exposure of the employee believed to have the greatest exposure. The exposure measurement shall be representative of the maximum exposure to the employee.

(4) If the exposure measurement taken pursuant to paragraph (e)(3) of this section reveals employee exposure to airborne concentrations of toluene in excess of the action level or ceiling limit, the employer shall:

(i) Identify all employees who may be similarly exposed; and

(ii) Measure the exposures of the employees so identified.

(5) If exposure measurements reveal employee exposure at or above the action level, but below the TWA or ceiling limit, without regard to the use of respirators, the employer shall repeat measurements for such employees at least every three months.

(6) If exposure measurements reveal employee exposure to be above the TWA or ceiling limit, the employer shall:

(i) Inform the employee in writing of the exposure as required by paragraph (e)(11) of this section;

(ii) Measure the exposure of the employee at least monthly; and

(iii) Institute control measures as required by paragraph (f) of this section.

(7) If two consecutive employee exposure measurements, taken at least one week apart, reveal that the employee is exposed to airborne concentrations to toluene below the action level, the employer may terminate monitoring for the employee.

(8) A record of all measurements shall be made and shall include at least the information required in paragraph (o)(2) of this section.

(9) Where a determination conducted under paragraph (e)(1) of this section shows the possibility of employee exposure by skin or eye contact with liquid toluene, the employer shall provide such employee with protective devices and clothing in accordance with paragraph (h) of this section.

(10) *Redetermination.* Whenever there has been a production, process or control change which may result in new or additional exposures, or whenever the employer has any other reason to suspect a change in exposure conditions, a new determination under paragraph (e)(1) of this section shall be made.

(11) *Employee notification.* The employer shall individually notify in writing, within 5 working days after receipt of measurement results, every employee who is found to be exposed to toluene above the TWA or ceiling limit. Such notification need not be given more frequently than once a month. The employee shall also be notified of the corrective action being taken to reduce exposure to within permissible limits.

(12) *Method and accuracy of measurement.* (i) An employee's exposure shall be obtained by a combination of long-term and short-term samples which represent the employee's actual exposure as averaged over an 8-hour work shift (See Appendix B).

(ii) The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below:

TABLE 1

Concentration:	*Maximum required accuracy (percent)*
At or below permissible exposure	±35
Above permissible exposure	±25

(Methods meeting these accuracy requirements are available from NIOSH.)

(f) *Methods of compliance.* Employee exposures to toluene shall be controlled to or below the TWA and below the ceiling limit provided in paragraph (c) of this section by engineering controls, work practice controls, and personal protection controls as follows:

(1) *Engineering and work practice controls.* (i) Engineering controls shall be instituted immediately to reduce exposures to or below the TWA and below the ceiling limit, except to the extent that such controls are not feasible.

(ii) Wherever feasible engineering controls which can be instituted immediately are not sufficient to reduce exposures to or below the TWA and below the ceiling limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by work practice controls.

(iii) Where engineering controls and work practice controls are not sufficient to reduce exposures to or below the permissible limits, they shall nonetheless be used to reduce exposures to the lowest possible level, and shall be supplemented by the use of respirators, in accordance with paragraph (f)(2) of this section.

(iv) A program shall be established and implemented to reduce exposures to or below the TWA and below the ceiling limit, or to the greatest extent feasible, solely by means of engineering controls.

(v) Written plans for such a program shall be developed and furnished upon request for examination and copying to the Secretary and the Director. Such plans shall be reviewed and revised at least every six months to reflect the current status of the program.

(vi) (A) When mechanical ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system to control the exposure, shall be made at least every three months. Measurements of the system's effectiveness to control exposure shall also be made within five days of any change in production, process or control which might result in any change in airborne concentrations of toluene.

(B) In the design of open surface tank ventilation for the purposes of § 1910.94(c), operations involving toluene shall be classified as B–1 at 70 degrees F.

(C) Where a fan is located in any duct work where toluene may be present in concentrations greater than 3,175 ppm (25% of the lower explosive limit), the fan rotating element shall be non-sparking or the casing shall consist of, or be lined with, non-sparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(2) *Respiratory protection.* (i) *Required use.* Where respirators are required under this section, compliance with the permissible exposure limit may not be achieved by the use of respirators except:

(A) During the time period necessary to install engineering or work practice controls; or

(B) In work operations in which engineering and work practice controls are not feasible; or

(C) In work situations in which engineering controls and supplemental work practice controls are insufficient to reduce exposures to or below the TWA or below the ceiling limit; or

(D) In emergencies.

(ii) *Respirator selection.* (A) Where respirators are required by this section, the employer shall select and provide an appropriate respirator from Table 2 below and shall ensure that the affected employee uses the respirator provided.

TABLE 2

RESPIRATORY PROTECTION FOR TOLUENE

Maximum toluene concentrations in air in parts per million	*Equipment selection options*
1,000 (10 by TWA limit) (use any equipment listed).	(1) Chemical cartridge respirator with replaceable organic vapor cartridge and half-mask facepiece (30 CFR 11.150). (2) Any supplied-air respirator (30 CFR 11.110).
3,000 (30 by TWA limit) (use any equipment listed beginning with item (3)).	(3) Any supplied-air breathing apparatus with full facepiece or a pressure demand or constant demand or constant flow half-mask facepiece (30 CFR 11.110).
Escape from an area of unknown concentration (use any equipment listed beginning with (4)).	(4) Gas mask, chin style or front or back mounted organic vapor canister with full facepiece (30 CFR 11.90(a) (1), (2) and (3)).
Entry into an area of unknown concentration for emergency purposes only—with full firefighters protective clothing (use only items (5) and (6) from equipment list).	(5) Self-contained breathing apparatus, pressure demand, with full facepiece (30 CFR 11.70(a)(2)(ii)). (6) Combination airline respirator, pressure demand or constant flow, with auxiliary self-contained air supply and full facepiece (30 CFR 11.70(b)).

(B) The appropriate respirator in accordance with Table 2 must be worn at any time the ceiling concentration is exceeded.

(C) Respirators shall be selected from those approved by the Mining Enforcement and Safety Administration (MESA) or by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) *Respirator program.* (A) The employer shall institute a respiratory protection program in accordance with § 1910.134(b).

(B) Respirators shall be used and maintained in accordance with § 1910.134 (d), (e), and (f).

(C) Employees who wear respirators shall be allowed to leave work areas to wash the face and respirator facepiece to prevent potential skin irritation associated with respirator use.

(g) *Hazardous operations and emergency situations*—(1) *Hazardous operations.* (i) Employees engaged in hazardous operations, as defined by paragraph (b)(3) of this section, such as, but not limited to cleaning of storage tanks, reaction vessels, pumps, distribution lines, and valves, or other maintenance operations, shall be provided with and required to use:

(A) Respiratory protection in accordance with paragraph (f)(2) of this section; and

(B) Appropriate protective clothing, in accordance with paragraph (h) of this section to prevent eye contact or repeated skin contact with liquid toluene. The protective clothing shall be selected for the operation and its possible exposure conditions.

(ii) Cleaning of or entry into tanks which have contained toluene shall be performed in accordance with § 1910.94 (d)(11)(ii), (iii), (iv) and (v).

(2) *Emergencies.* (i) A written plan for emergency situations shall be developed for each facility involved in a toluene operation in which there is a possibility of an emergency as defined by paragraph (b)(2) of this section. Appropriate portions of the plan shall be implemented in the event of an emergency.

(ii) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped as required in paragraphs (f)(2) and (h) of this section until the emergency is abated.

(iii) Employees not engaged in correcting the emergency shall be restricted from the area and normal operations in the affected area shall not be resumed until the emergency is abated.

(h) *Protective equipment.* (1) Where splashes, sprays, spills, or skin or eye contact with liquid toluene may occur:

(i) employers shall provide and require employees to wear impermeable clothing, gloves, or coverings to protect the area of the body likely to come in contact with liquid toluene in accordance with § 1910.94(d)(9)(ii), (iii), (iv) and (v).

(ii) Eye and face protection shall be provided in accordance with § 1910.133 (a)(2), (3), (4), (5) and (6).

(i) *Fire and safety.* The employer shall familiarize himself with the information contained in the substance technical guidelines for toluene (Appendix B) in order to ensure the safe handling and use of toluene.

(1) For the purposes of compliance with §§ 1910.308 and 1910.178, locations classified as hazardous due to the presence of toluene shall be Class I, Group D.

(2) For the purpose of compliance with § 1910.157, toluene is classified as a Class B fire hazard.

(3) For the purpose of compliance with § 1910.106, liquid toluene is classified as a Class IB flammable liquid. Spray finishing operations shall be performed in accordance with §§ 1910.107 and 1910.94(c). Dip tank operations shall be performed in accordance with §§ 1910.108 and 1910.94(d).

(4) Sources of ignition such as smoking or open flames shall be prohibited where toluene is used or stored.

(j) *Housekeeping.* (1) Spills of toluene which may result in exposure in excess of the TWA or ceiling limits or which may expose employees to the risk of skin or eye contact shall be cleaned up immediately by persons wearing appropriate protective equipment. Persons not wearing approved respiratory protection and appropriate protective equipment shall not be allowed in areas of the spills until cleanup has been completed or the concentration of toluene is within permissible levels.

(2) The workplace shall be kept clean in accordance with § 1910.141(a)(3).

(3) Toluene waste shall be collected and disposed of in closed metal containers.

(k) *Sanitation.* (1) The employer shall provide an adequate number of washing facilities, soap and water in accordance with § 1910.141(d).

(2) The employer shall provide eye wash facilities that are suitable for quick drenching or flushing of the eyes for immediate emergency use where toluene is handled.

(l) *Employee information and training*—(1) *Training program.* (i) The employer shall provide a training program for employees assigned to workplace areas in which toluene is produced, released, packaged, repackaged, stored, handled or used.

(ii) The training program shall be provided at the time of initial assignment, and at least annually thereafter, and shall include informing each employee of:

(A) The information contained in the substance data sheets for toluene, which is contained in Appendices A and B;

(B) The quantity, location, manner of use, release or storage of toluene, and the specific nature of operations which could result in exposure at or above the action level as well as necessary protective steps;

(C) The purpose, proper use, and limitations of respiratory devices as specified in § 1910.134;

(D) The purpose, and a description of, the medical surveillance program as required by paragraph (n) of this section, and the information contained in Appendix C;

(E) Emergency procedures as required by paragraph (g)(2) of this section; and

(F) A review of this standard.

(2) *Access to training materials.* (i) A copy of this standard and its appendices shall be made readily available to all employees exposed to toluene.

(ii) All materials relating to the employee information and training program shall be provided upon request to the Secretary and the Director.

(m) *Labels.* (1) Labels required by this paragraph may be in addition to or in combination with labels required by other statutes, regulations or ordinances.

(2) No statement shall appear on or near any required label or instruction which contradicts or detracts from the effect of such required label or instruction.

(3) Precautionary labels shall be applied to all containers, packages or equipment containing toluene. The label shall provide at least the following information:

(i) The word "CAUTION" or "WARNING,"

(ii) The word "TOLUENE"

(iii) A warning statement that the substance is toxic and flammable; and

(iv) A warning statement against breathing vapors and against having skin or eye contact with liquid toluene.

(n) *Medical surveillance*—(1) *General requirements.* (i) Each employer who has a place of employment in which employees are, or will be exposed to concentrations of toluene, at or above the action level or in excess of the ceiling level, without regard to the use of respirators, shall institute a medical surveillance program.

(ii) The program shall provide each affected employee with an opportunity for medical examinations in accordance with this paragraph.

(iii) If any employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and shall obtain a signed statement from the employee indicating that the employee understands the risk involved in the refusal to be examined.

(iv) All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided during the employee's normal working hours, without cost to the employee.

(2) *Initial examinations.* At the time of initial assignment, or upon institution of medical surveillance, the following shall be performed by the physician:

(i) A medical history, which shall cover at least:

(A) Cardiac problems and pulmonary diseases;

(B) Kidney disease;

(C) Liver disease;

(D) Incidences of headache, nausea, dizziness;

(E) Eye complaints;

(F) Irritation of mucous membranes; and

(G) Skin irritations;

(ii) A complete work history; and

(iii) A medical examination which must include at least the following:

(A) A general physical examination;

(B) Uurinalysis;

(C) Pulmonary function test; and

(D) Complete blood count;

(3) *Periodic examinations.* Examinations specified in this paragraph shall be performed at least annually for all employees specified in paragraph (n)(1) of this section.

(4) *Alternative medical examinations.* If the examining physician determines that medical examinations alternative to those specified in paragraph (n)(2) of this section will provide at least equal assurance of detecting medical conditions pertinent to protecting the employee against exposure to toluene, the employer may accept such alternative medical surveillance examinations as meeting the requirements of paragraph (n) of this section, provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for their substitution and submits such statement to the Secretary; and

(ii) Informs each exposed employee of the fact that alternative medical examinations to those required in paragraph (n)(2) of this section are to be made available.

(5) *Interim examinations.* (i) Each employee exposed to toluene due to the occurrence of an emergency shall be provided the medical examinations prescribed in paragraph (n)(2) of this section.

(ii) If the employee is accidentally or otherwise exposed by ingestion, inhalation or by skin or eye contact under conditions known or suspected to be hazardous, or for any reason develops signs and symptoms commonly associated with toxic exposure to toluene, the employer shall provide appropriate emergency medical treatment.

(6) *Information provided to the physician.* The employer shall provide the following information to the examining physician.

(i) A copy of this regulation for toluene including Appendices A, B, and C.

(ii) A description of the affected employee's duties as they relate to his exposure;

(iii) A description of any personal protective equipment used;

(iv) The results of the employee's exposure measurement, if available;

(v) The employee's anticipated exposure level; and

(vi) Upon request of the physician, information from previous medical examinations of the affected employee.

(7) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician, containing the following:

(A) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of his health from exposure to toluene, or which would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to toluene and upon the use of protective equipment and respirators; and

(C) A statement that the employee has been informed by the physician of any medical conditions which require further examination or treatment.

(ii) The written opinion shall not reveal specific findings or diagnoses unrelated to occupational exposure.

(iii) A copy of the physician's written opinion shall be provided each employee.

(iv) If the employer determines, on the basis of the physician's written opinion, that any employee's health would be materially impaired by continued exposure to toluene, such employee shall be withdrawn from possible exposure to toluene.

(o) *Recordkeeping.* (1) *Exposure determinations.* The employer shall keep an accurate record of all determinations as prescribed in paragraphs (e)(1) and (e)(2) of this section.

(i) This record shall include the written determination and any supporting documentation required in paragraph (e)(2) of this section.

(ii) This record shall be maintained for at least two years and shall include the most recent determination.

(2) *Measurement.* The employer shall keep an accurate record of all measurements taken to monitor employee exposure to toluene.

(i) This record shall include;

(A) The date of measurements;

(B) The operation involving exposure to toluene which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, and social security number, and exposure of the employee monitored.

(ii) This record shall be maintained for at least 10 years.

(3) *Mechanical ventilation measurements.* When mechanical ventilation is used as an engineering control, the employer shall maintain a record of the measurements demonstrating the effectiveness of such ventilation as required by paragraph (f)(1)(v) of this section.

(i) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken; and

(C) Result of measurement.

(ii) This record shall be maintained for at least 2 years.

(4) *Employee training.* The employer shall keep an accurate record of all employee training required by paragraph (1) of this section.

(i) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained; and

(C) Content or scope of training provided.

(ii) This record shall be maintained for at least 2 years.

(5) *Medical surveillance.* The employer shall keep an accurate medical record for each employee subject to medical surveillance required by paragraph (n) of this section.

(i) The record shall include:

(A) Physician's written opinion;

(B) Any employee medical complaints related to exposure to toluene;

(C) A copy of the information provided to the physician as required by paragraph (n)(6) of this section; and

(D) A signed statement of any refusal to be examined, as required by paragraph (n)(3) of this section.

(ii) This record shall be maintained for at least 10 years.

(6) *Availability.* (i) All records required to be maintained by this section shall be made available upon request to the Secretary and the Director for examination and copying.

(ii) Written determinations and employee exposure measurements records as required by paragraphs (o)(1) and (o)(2) of this section shall be made available for examination and copying to employees, former employees, and their designated representatives.

(iii) Employee medical records required to be maintained by this section shall be made available upon request for

examination and copying to a physician designated by the employee or former employee.

(7) *Transfer of records.* (i) In the event the employer ceases to do business, the successor shall receive and retain all records required to be maintained by this section.

(ii) In the event the employer ceases to do business and there is no successor to receive and retain his records, these records shall be transmitted by registered mail to the Director, and each employee and former employee shall be individually notified in writing of this transfer.

(p) *Observation of monitoring.* (1) *Employee observation.* The employer shall give his employees or their representatives an opportunity to observe any measuring of their exposure to toluene which is conducted pursuant to this section.

(2) *Observation procedures.* (i) When observation of the monitoring of employee exposure to toluene requires entry into an area where the use of personal protective equipment is required, the observer shall be provided with and required to use such equipment and shall comply with all other applicable safety procedures.

(ii) Without interfering with the measurement, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the measurement of airborne concentrations of toluene performed at the place of exposure; and

(C) Record the results obtained.

(q) *Effective date.* This standard shall become effective 30 days following publication of the final standard in the FEDERAL REGISTER.

(r) *Start-up dates*—(1) *Determination and measurement.* (i) Determinations and measurements prescribed in paragraph (e) of this section shall be instituted within three months of the effective date of the final standard except that for new production areas or operations, such determinations and measurements shall be instituted within 30 days of startup of operation.

(2) *Medical surveillance.* Medical surveillance prescribed in paragraph (n) of this section shall be instituted within three months of the effective date of the final standard.

(s) *Appendices.* The information contained in the appendices of this section is not intended, in itself, to create any additional obligations not otherwise imposed by the standard, or to detract from any existing obligations.

APPENDIX A—SUBSTANCE SAFETY DATA SHEET

TOLUENE

I. *Substance identification*

A. *Substance:* Toluene.

NOTE.—Poorer grades of toluene may contain as much as 25% benzene, which can result in vapor containing 50% benzene. Since benzene presents a much greater hazard to health than toluene, its presence as a contaminant is of prime concern.

B. *Permissible Exposures*—(1) *Airborne.* 100 parts of toluene vapor per million parts of air (ppm) averaged over an 8-hour work shift (8-hour TWA) based on a 40-hour week, and a ceiling of 200 ppm determined using a sampling time of 15 minutes.

(2) *Eye and skin.* Eye contact or repeated skin contact with liquid toluene is prohibited.

(3) *Ingestion.* All necessary precautions should be taken to prevent ingestion of liquid toluene.

C. *Appearance and odor.* Toluene is a colorless, non-corrosive liquid with a benzene-like odor. At first, the odor of toluene is easily noticeable at concentrations of 200 ppm, but as exposure continues, the sense of smell becomes dulled so that odor cannot be used as a reliable warning.

II. *Health hazard data.*

(A) *General:* Medical effects may result from breathing air contaminated with toluene vapor. Toluene may also affect your body if the liquid form contacts your eyes or skin, or if you swallow it.

(B) *Effects of Overexposure:* (1) *Short-term Exposure.* Breathing air contaminated with toluene vapor produces headaches, muscular weakness, nausea, mental confusion, incoordination, drowsiness and fatigue. On contact with the skin, toluene may cause a temporary burning sensation. In contact with the eyes, the liquid can cause serious burns.

(2) *Long-term Exposure.* Repeated daily exposures to air concentrations significantly above the permissible limits will produce chronic intoxication manifested by nervousness, insomnia, fatigue and loss of appetite and weight. Repeated exposures to very high concentrations (producing marked acute effects) over long periods of time may cause permanent brain damage. Repeated contact with the liquid will cause drying and cracking of the skin, which may result in dermatitis.

(3) *Reporting Signs and Symptoms.* If you develop any of the signs or symtoms noted above due to exposure to toluene, inform your employer.

III. *Emergency first aid procedures*

(A) *Eye Exposure.* If liquid toluene gets into your eyes, wash your eyes immediately with large amounts of water. Remove contact lenses if worn. Call a physician as soon as possible.

(B) *Skin Exposure.* If liquid toluene gets on your skin, wash promptly using large quantities of water. If toluene soaks through your clothing, remove the clothing promptly and wash the skin. If irritation persists, get medical attention.

(C) *Breathing.* If you or any other person breathes in a large amount of toluene vapor move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention immediately.

(D) *Swallowing.* If you or any other person swallows toluene, do not cause the person to vomit. Get medical attention immediately.

(E) *Rescue.* Move affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. *Respirators and protective clothing.*

(A) *Respirators.* You must wear a respirator whenever you are in an atmosphere where toulene concentrations exceed the permissible limits. However, respirators can only be required for routine use if your employer is in the process of installing controls, or in situations where these controls cannot feasibly reduce exposure levels to within permissible limits. If respirators are worn, they must have a U.S. Bureau of Mines (BM), Mining Enforcement Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) seal of approval. If you experience difficulty breathing while wearing a respirator, tell your employer.

(B) *Clothing.* Your employer must supply you with the appropriate work clothing to prevent repeated contact with liquid toluene.

(C) *Eye and Face Protection.* You must wear splash-proof safety goggles whenever it is possible for liquid toluene to come into contact with your eyes. Also, a face shield must be worn if there is danger of splashing toluene on your face.

V. *Precautions for safe use, handling, and storage.*

Toluene should be stored in a cool, dry, well ventilated area. Your supervisor must tell you where toluene is used in your work area, and about any additional plant safety procedures.

APPENDIX B—SUBSTANCE TECHNICAL GUIDELINES

TOLUENE

I. *Physical and chemical data*

(A) *Identification*—(1) *Synonyms:* Toluol, methylbenzene, methacide, phenylmethane

(2) Formula: $C_6H_5CH_3$

(B) *Physical Data*

(1) Boiling Point (760 mm Hg): 110.60 C (231° F)

(2) Specific Gravity (20° C): 0.866

(3) Vapor Density (air =1): 3.14

(4) Melting Point: −95° C (−139° F)

(5) Vapor pressure 25° C (77° F): 28 mm Hg

(6) Solubility: Not soluble in water but miscible with most organic solvents.

(7) Evaporation Rate: Moderate.

(8) Appearance: Colorless liquid

(9) Odor: Aromatic, benzene-like

II. *Fire, explosion and reactivity hazard data*

(A) *Fire*

(1) Flash Point (closed cup): 4.4 C (40° F)

(2) Autoignition Temperature: 552° C (1026° F)

(3) Flammable Limits in Air, percent by volume: Lower 1.27 Upper: 7.0

B. *Reactivity*

(1) Conditions contributing to instability: Heat

(2) Incompatibility: Acids and oxidizing materials

(3) Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide)

III. *Spill and leak procedures.*

(A) Steps to be taken if toluene is released or spilled: Large amounts of water spray should be used to flush the spills. Do not flush toluene into a confined space, such as a sewer, because of explosion danger. Remove all ignition sources. Ventilate enclosed places.

(B) Persons not wearing protective equipment should be restricted from areas of spills until cleanup has been completed.

(C) *Waste Disposal Method.* Disposal methods must conform to regulations of agencies having jurisdiction. If allowed toluene may be disposed of: (a) by absorbing it in dry sand or earth and disposing in a sanitary land fill; (b) If small quantities, by removing it to a safe location away from buildings or other combustibles, pouring it on dry sand or earth and cautiously igniting it; (c) if large quantities, by atomizing in a suitable combustion chamber.

IV. Monitoring and measurement procedures

(A) *Exposures Above Action Level.* Measurements taken for the purpose of determining employee exposure are best taken in a fashion such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short time interval samples (up to 30 minutes) may also be used to determine the average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analysis may be performed by instruments, such as portable direct-reading instruments, gas and vapor absorption tubes with subsequent chemical analysis, dosimeters, or continuous monitoring systems that can sample and analyze those amounts most likely to represent the highest airborne concentrations of toluene to which employees are exposed. The analytical method must determine the concentration of toluene to plus or minus 35%.

B. *Exposures Above Permissible Limits.* This monitoring method should be essentially the same as described above, except that portable direct reading instruments should be NIOSH-certified and should receive regular maintenance and calibration. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The analytical method must determine the concentration of toluene to plus or minus 25%.

V. *Miscellaneous precautions*

A. High exposure to toluene can occur when transferring the liquid from one container to another. Such operations should be well-ventilated and good work practices should be established to avoid spills.

B. Non-sparking tools should be used to open toluene containers, and the containers should be effectively grounded and bonded prior to pouring.

C. Employers should advise employees of all plant areas and operations where exposure to toluene could occur. A few of the common operations in which high exposures to toluene may be encountered are manufacture of benzene, gasoline, explosives, lacquer, varnish and rubber cement.

APPENDIX C—MEDICAL SURVEILLANCE GUIDELINES

I. Route of entry—Primarily inhalation; also skin and eye contact, ingestion.

II. Toxicology—Toluene is a central nervous system depressant. It can also cause a skin irritation upon prolonged skin contact with liquid toluene.

III. Signs and symptoms—Headache, nausea, dizziness, uncoordination, mental confusion, fatigue, irritation of eyes and skin, and irritation of respiratory tract.

IV. Special tests—None in common usage.

V. Treatment—Remove from exposure. Flush eyes and skin with water.

If swallowed, do not make person vomit.

VI. Surveillance and preventive considerations—A. *Preplacement.* A routine medical examination and a complete medical and work history are required to be made available. Those employees giving a positive history on these conditions (listed below) should not be placed where there is increased risk from toluene.

1. *Skin disease.* Liquid toluene can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.

2. *Liver and kidney disease.* There have been reported cases of liver enlargement due to inhalation of toluene. Although this is not common, people with liver disease should not be placed in an area of possible exposure.

3. *Those suffering from paralysis, convulsive seizures, and highly nervous states.* As toluene is a central nervous system depressant, people with these types of problems should not be exposed to high levels of this solvent.

C. *Periodic examinations:* Annual physical examinations are required to be made available. These should include as a minimum a urinalysis, CBC, a pulmonary function test.

3. In § 1910.19, the subject heading is changed and the following paragraph is proposed to be added to read as follows:

§ 1910.19 Special provisions for air contaminants.

* * * * *

Section 1910.1029 shall apply to the exposure of every employee to toluene vapor, mist, or liquid in every employment covered by §§ 1910.12, 1910.13, 1910.14, 1910.15, and 1910.16, in lieu of any different standard on exposure to toluene which would otherwise be applicable by virtue of any of those sections.

(Secs. 4, 6, 8, 84 Stat. 1592, 1593, 1599 (29 U.S.C. 653, 655, 657) and 29 CFR Part 1911).

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